

**REMARKS**

**I. Summary of Office Action and Examiner Interview**

Claims 90 and 123 are objected to for depending upon a non-elected claim.

Claims 91 and 122 are objected to under 37 CFR 1.75 as being substantial duplicates of claim 51.

Claims 51-53, 57-59, 61-67, 69-71, 73-92, 122, and 123 remain rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,304,366 (Lorentz) in view of U.S. Patent No. 5,985,232 (Howard '232).

Applicants thank Examiner McCracken for the helpful and courteous discussion held with the Applicants' representatives on April 3, 2008. Proposed amendments to the claims and differences between the cited references were discussed, substance of which is more fully explained below.

**II. Information Disclosure Statement**

Applicants are also submitting herewith an Information Disclosure Statement (IDS).

Applicants further note that the IDS submitted on December 28, 2007 was not indicated to have been considered in the Office Action dated January 10, 2008.

Applicants respectfully request the Examiner to consider these submission and provide the Applicants with the initialed Form SB/08, indicating that all the references submitted in the IDSes have been considered.

**III. Amendments to the Claims**

Claim 3 is canceled.

Claims 124-126 are added.

Claims 1, 2, 8, 9, 51, 57, 58, 91, 120, and 122 are currently amended.

Support for the new claims and amendments to the claims can be found throughout the specification. For example, support can be found at paragraphs [0048], [0064], and [0072] of U.S. Publication No. 2004/0057896.

#### **IV. Double Patenting**

The Examiner has asserted that claims 91 and 122 are objected to under 37 CFR 1.75 as being substantial duplicates of claim 51. Applicants respectfully disagree. Amendment to claim 91 renders the objection moot. Claim 122 also differs in scope as claim 51 recites “burning a carbon-containing fuel in a combustion chamber under conditions effective to produce fullerenes and to generate a first gas stream” whereas claim 122 recites “generating a first gas stream.” Accordingly, Applicants submit claims 91 and 122 are not substantial duplicates of claim 51 and request withdrawal of the objection under 37 CFR 1.75.

#### **V. Objections to Claims 90 and 123**

The Examiner has objected to claims 90 and 123 for depending upon a non-elected claim. Applicants respectfully submit that these claims are dependent on Group I (claims 1-93 and 117-121) identified in the Restriction Requirement dated June 27, 2006. Although Applicants have provisionally elected Species B (claims 51-93) in Group I, Applicants have requested the Examiner to expand the examination to the unelected species upon finding the allowability of Species B (see MPEP §809). Accordingly, Applicants submit amendments are not needed to claims 90 and 123 at this time.

#### **VI. 35 U.S.C. § 103 Rejection**

At the outset, Applicants thank Examiner McCracken for withdrawing all the rejections of the previous office action. However, new rejection under 35 USC §103(a) over Lorents in view of Howard '232 was asserted.

Lorents describes the formation of fullerenes using an evaporation means 10 which “comprises an evaporation chamber 12 containing two spaced apart and opposed graphite electrodes 20 and 22.” (col. 2, lines 41-43). “In a typical arrangement, ¼” diameter graphite rods about 12” long are spaced apart in chamber 12 to provide a gap therebetween ranging from

about 1 mm to about 5 mm, and an AC or DC arc is struck across the gap using a high current 20-30 volt power supply 23 with a current of from about 50 to about 200 amps flowing across the gap to vaporize or evaporate the graphite electrodes.” (col. 2, lines 61-68). In short, Lorents is describing the formation of fullerenes using an *arc discharge*.

However, as one of ordinary skill in the art would recognize, *arc discharge* does not produce any polycyclic aromatic hydrocarbons (PAH) as hydrogen is not involved in this mechanism of fullerene formation. In contrast, in other fullerene forming mechanisms that involve hydrogen, such as combustion, PAH is generated along with or as a precursor to fullerenes. Some of the PAH can be converted to fullerene while others remain as PAH. This PAH must be accounted for in addition to the existence of the soot. Therefore, in fullerene-forming mechanisms that involve hydrogen, there is an added layer of complexity in obtaining purified fullerenes that does not exist in an *arc discharge* fullerene forming mechanism described in Lorents. Namely, fullerenes must be separated from not only soot but also from PAH.

As the claims recite, Applicants have realized that one embodiment for obtaining purified fullerenes is to reduce the PAH content in the first gas stream containing gaseous fullerenes, PAH, and soot prior to the separation of solid soot from gaseous fullerenes (see, e.g., paragraphs [0048] and [0064]; see also claims 1, 8, 9, 51, 57, 58, and 122). For example, claims 8, 9, 57, and 58 describe controlling the residence time of the first gas stream containing gaseous fullerenes, PAH, and soot to reduce the PAH content.

Applicants further direct Examiner’s attention to paragraph [0108] of US Publication No. 2004/0057896, which indicates that the “low amount of PAH was attributed to the residence time (100-500 ms) and temperature (500°C-1700°C, preferably between 900 °C to 1500 °C) provided in the first conduit between the combustion chamber and the soot filter, which reduced the PAH levels through chemical and physical interactions with other species present in the gases.” No such result-effective variables to reduce PAH content is (or can be) described or suggested in Lorents.

Howard ‘232 fails to remedy the deficiency described above. As described in the Amendment dated December 5, 2007, Howard ‘232 does not teach or suggest separating gaseous fullerenes from solid soot using a filter as claimed in the independent claims. In fact,

Howard '232 describes collection of solid soot and solid fullerenes (col. 7, lines 62-65; see also col. 7, lines 41-65) subsequently followed by separation of the fullerenes from soot by, for example, soxhlet extraction (see col. 8, lines 7-30). Accordingly, Howard '232 also fails to describe or suggest that PAH content can be reduced prior to separation of solid soot from gaseous fullerenes.

Accordingly, Applicants submit that independent claims 51 and 122 are allowable for at least the reasons stated above. Applicants submit that claims which directly or indirectly depend on independent claims 51 or 122 are also allowable for at least the reasons stated above. Reconsideration and withdrawal of the rejections is respectfully requested.

In an alternative embodiment, the fullerenes can be condensed at conditions where non-fullerene species, such as PAH, are not substantially condensed. For example, independent claim 91 recite "condensing at least a portion of the gaseous fullerenes in the second gas stream at a temperature between about 100 °C to about 800 °C to allow at least a portion of PAH in the second gas stream to remain as gaseous PAH in the second gas stream." (See also dependent claims 41, 42, 83, and 84). This is an alternative and/or additional embodiment to achieve greater purity of fullerenes relative to the PAH (or non-fullerene species) content, reducing the need to perform post-collection separation utilizing expensive/undesirable separation techniques such as HPLC, soxhlet extraction, and the like. However, the cited references, either alone or in combination, fail to describe or suggest that fullerenes with reduced non-fullerene species (e.g., PAH) content can be collected by controlling the conditions of the fullerene condensation and/or collection as recited in the claims. Accordingly, Applicants submit claim 91, and claims dependent therefrom, and claims 41, 42, 83, and 84 are also allowable at least the reasons noted herein.

Lastly, as generic claim 122 is allowable, Applicants request the Examiner to also consider claims that have been withdrawn from consideration (see MPEP §809). Upon consideration of these claims, Applicants submit that the withdrawn claims are also allowable for at least the reasons stated above.

### **VII. Conclusion**

Applicants are submitting herewith a petition for an extension of time with the payment of the requisite fees. As such, this response is being timely filed. In the event that additional extensions of time are required, the Commissioner is requested to grant a petition for that extension of time, which is required to make this response timely. The Commissioner is hereby authorized to charge any additional fees or credit any overpayment to Deposit Account No. 08-0219.

In view of the above amendment and remarks, Applicants believe the pending application is now in condition for allowance. Early notification of such is earnestly solicited.

Respectfully submitted,

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